

## Treatment of a Nonresponding Port-Wine Stain With a New Pulsed Light Source (PhotoDerm® VL)

Christian Raulin, MD,<sup>1\*</sup> Stefanie Hellwig, MD,<sup>1</sup> and  
Matthias P. Schönermark, MD<sup>2</sup>

<sup>1</sup>Center for Dermatologic Laser Surgery, D-76133 Karlsruhe, Germany

<sup>2</sup>Department of Otolaryngology/Head and Neck Surgery, Hannover Medical School,  
D-30623 Hannover, Germany

**Background and Objective:** The pulsed dye laser is effective and safe in the treatment of port-wine stains. It is the laser of choice for port-wine stains and initial superficial hemangiomas in children. For the treatment of darker port-wine stains in adults that have not responded to pulsed dye laser treatment, excellent results can be achieved using the PhotoDerm® VL, a new technology based upon the emission of wide band, noncoherent intense pulsed light.

**Study Design/Patient and Methods:** Our report presents a patient with a facial port-wine stain that hardly responded to previous pulsed dye laser therapy. After the first ineffective treatment trial, the patient refused further dye laser applications. An intense pulsed light source (Photoderm® VL) was applied instead.

**Results:** The lesion responded well after the first treatment session and was completely resolved after four treatments with the PhotoDerm® VL.

**Conclusion:** The new intense pulsed light source Photoderm® VL seems to be a promising treatment alternative for the therapy of otherwise nonresponding port-wine stains due to its special technical features. *Lasers Surg. Med.* 21:203–208, 1997.

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**Key words:** cosmetic laser surgery; dye laser; port-wine stains; teleangiectasia

### INTRODUCTION

In treatment of nevi flammei, the pulsed dye laser has proven to be a method with good to very good results while causing few side effects [1–8]. The pulsed dye laser was developed especially for bright red infantile nevi flammei, as other laser therapies (e.g., the often used Argon laser) had a high rate of scar formation [9–11]. Even the darker nevi flammei in adult patients respond to the pulsed dye laser therapy in most cases, although clearance takes longer and nodular areas show inferior response [4,10,12].

A new alternative to the pulsed dye laser is the PhotoDerm® VL, a pulsed light system with a broad spectrum of wavelengths ranging from 515

nm to 1,200 nm. PhotoDerm® VL has been developed for the treatment of a wide range of benign vascular lesions, including those located deeper in the skin such as essential telangiectasias, leg veins, and reticular varices [5,13]. The case study reported hereafter is one of 80 patients, who have been treated with either PhotoDerm® VL or the pulsed dye laser. The PhotoDerm® VL therapy was successfully completed after five treatments within 10 months.

\*Correspondence to: Dr. med. Christian Raulin, Center for Dermatologic Laser Therapy, Kaiserstr. 104, 76133 Karlsruhe, Germany.

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Fig. 1. Nevi flammei of the right face (December 1994) after a single treatment with the pulsed dye laser.



Fig. 2. After one treatment with the PhotoDerm® VL.



Fig. 3. April 1995, after the third treatment session.



Fig. 4. October 1995, after the fourth treatment session.



Fig. 5. January 1996, 3 months after the last PhotoDerm® VL treatment.

**TABLE 1. Treatment Parameters and Effect**

No. of treatment session	Laser type	Wavelength [nm] <sup>a</sup>	Pulse duration	Fluence [J/cm <sup>2</sup> ]	Improvement [%]
Initial	Pulsed dye	585	300–450 $\mu$ sec	6.5	0
1	Photoderm VL	550c/o	5 msec	25–27	45
2	Photoderm VL	550c/o	5 msec	26–28	55
3	Photoderm VL	510c/o	5 msec	32–35	70
4	Photoderm VL	550c/o	4.5 msec	31–33.5	80
5	Photoderm VL	550c/o	5 msec	27.5	93

<sup>a</sup>c/o = lower cutoff filter.



## MATERIALS AND METHODS

### Patient

The 35-year-old male suffered from a congenital widespread port-wine stain of the right half of the face. As the brother of the patient had had a rupture of a cerebral vessel, a Sturge-Weber-Syndrome was excluded in our patient before the therapy was started. Initial treatment was conducted in March 1993, with a pulsed dye laser with a wave length of 585 nm and a pulse duration of 300–450 microsec (Photo Genica V, Cynosure, Boston, MA). The entire area was treated with an energy fluence of 6.5 J/cm<sup>2</sup> and a pulse diameter of 5 mm (Table 1). After the patient rejected any further dye laser treatment, we offered a treatment trial with the PhotoDerm® VL (ESC, Haifa; Israel). PhotoDerm® VL, an intense pulsed light system works on the basis of a broad spectrum of wavelengths from 515 nm to 1,200 nm. The pulse durations range from 2 ms to 25 ms; the energy fluence can be varied from 3 J/cm<sup>2</sup> to 90 J/cm<sup>2</sup>. The pulse sequence can be applied in single, double, and triple pulse mode. In contrast to lasers, PhotoDerm® VL emits noncoherent light. Because of the spot size of 8 × 35 mm (2.8 cm<sup>2</sup>), the area treated in one pulse is relatively large, which allows one to limit the total number of pulses per treatment to a minimum. During all four treatment sessions, the 550 nm lower cutoff spectrum filter, single and double pulses, and energy fluence of 25–26 J/cm<sup>2</sup> were applied (Table 1). As PhotoDerm® VL therapy causes only mild discomfort, no local anaesthesia was necessary. The treated area was cooled immediately with ice packs in order to soothe the slight burning and to avoid possible posttherapeutical swelling.

### RESULTS

After the first treatment with the pulsed dye laser, no clearance of the port-wine stain was noted (Fig. 1). Not even a faint improvement of the lesion was detected, which is unusual in dye laser therapy. Moreover, the circular intracutaneous haematomata, the imprints of every single laser pulse, remained for 10 days and were extremely disturbing to the patient. The patient refused any further treatment with the pulsed dye laser device. Therefore, we offered a treatment trial with the PhotoDerm® VL. After the first treatment with the PhotoDerm® VL in December 1994, the nevus flammeus showed considerable clearance (Fig. 2). The area was treated with a

550 nm lower cutoff spectrum filter, single and double pulses of 4.5–5 ms duration, and an energy fluence of 25–35 J/cm<sup>2</sup> (Table 1). The only noticeable side effect was slight erythema, which lasted for 24 hours. Swelling was prohibited by local cooling after the treatment, and no local anaesthesia was needed. In four consecutive sessions in February, April, July (Fig. 3), and October 1995 (Fig. 4), the port-wine stain was completely cleared. The lesion responded to every single treatment session. Figure 5 shows the clinical picture as of January 1996. The figures were scanned and the cleared area was measured with an image analyzer software, allowing a semiquantitative determination of treatment efficiency (Table 1). There were no side effects, apart from a discrete erythema and slight purpura, which occurred immediately after the treatment and resolved within 24 hours. The patient was instructed to avoid any exposure to sunlight during the therapy.

### DISCUSSION

In contrast to lasers, PhotoDerm® VL emits noncoherent light with a wavelength spectrum ranging from 515 nm to 1,200 nm, which allows treatment of deeper-lying vessels. The variable pulse duration and the capability of longer pulse durations also play an important role in the selective treatment of larger and deeper vessels, which require higher fluence- without damaging surrounding tissue. As is the case with the pulsed dye laser, the target chromophores are the erythrocytes and the oxyhemoglobin. PhotoDerm® VL therapy is also based upon the principle of selective photothermolysis. The goal is to raise the blood vessel temperature high enough to cause its coagulation without damaging the epidermis and the surrounding tissue [14].

The Argon laser, which was frequently used for the treatment of port-wine stains [15–17], often caused hypertrophy or subsided scars, especially in children [11,15–18]. Hyper- and hypopigmentation occur in up to 16% of cases treated with the Argon laser [17]. The treatment of infantile nevi flammei with the Argon laser, meanwhile, is considered obsolete.

The pulsed dye laser was especially developed for the treatment of infantile port-wine stains [1,2,7,8,10,17]. Even the usually darker nevi flammei in adults with nodular structures can be treated with a pulsed dye laser [4,12]. The pulsed dye laser is considered the "Gold Stan-

dard" in the therapy of port-wine stains. The clearance, however, takes longer and the so-called paving-stone-relief, nodular hypertrophy areas within the port-wine stain can hardly be influenced [7]. Damage of the surrounding tissue as well as scar formation can almost be excluded [1-5,7,8,12].

The PhotoDerm® VL is an alternative to the pulsed dye laser, especially in the case of nevi flammei, which do not respond to pulsed dye laser therapy [5,19]. The reason why some of the port-wine stains do not respond to the pulsed dye laser therapy is not yet clear. Vessel diameter and location of the vessel in different depths seem to play a considerable role. High resolution ultrasound examinations with the colour duplex mode might be helpful in solving the problem.

Due to the larger spot size of the PhotoDerm® VL (2.8 cm<sup>2</sup> vs. 0.3cm<sup>2</sup>; a new larger spot size [1 cm<sup>2</sup>] is now available), the area treated by one single pulse is considerably larger. Also, the large spot size assures deeper penetration of the light due to reduced effects of light scattering. The erythema and the slight purpura that appear immediately after the treatment can be better tolerated by the patients than the dark purpura maculae that result after pulsed dye laser therapy. Slightly pronounced purpura and light to mid range erythema that may appear when using shorter pulses and higher energy are the only side effects of PhotoDerm® VL therapy when appropriate parameters are used. Scar formation has not been noticed in our patients. Caution and consideration of skin type are most important while applying the PhotoDerm® VL device. We would not recommend treating patients with skin type IV and V as transient or permanent hypopigmentation might occur.

Besides treatment of therapy-resistant port-wine stains, PhotoDerm® VL is very effective in the treatment of telangiectases (of the face, body, and extremities), erythrosis interfollucuaris colli, spider naevi, vessel malformations with large diameters, red keloids, and hypertrichosis [5,13].

The underlying principle of the PhotoDerm® VL is similar to the pulsed dye laser. Dermal vessels are thermally damaged due to selective photothermolysis, which eventually leads to their destruction and replacement by granulation tissue [11,20]. The pulse duration of the PhotoDerm® VL ranges well below the thermal relaxation time of smaller cutaneous blood vessels, so that the surrounding tissue is barely harmed. This is the reason for the very low rate of occurrence of purpura

with this device in contrast to the pulsed dye laser. Scar formation and skin atrophy after the treatment therefore appear very rarely. Hypo- and hyperpigmentation in the treated area that have been reported in some rare cases are almost always transient.

In summary, the PhotoDerm® VL is an alternative and a supplement to the pulsed dye laser in the treatment of nevi flammei. The device is especially effective for the treatment of not "therapy resistant" nevi flammei of adults, which often respond more poorly to the pulsed dye laser treatment than the bright red infantile port wine stains.

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